Customer No. 33401

Attorney Docket No. 073785-013

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
C. Earl WOOLFORK

Serial No.: 10/648,012

Filed: August 26, 2003

For: WIRELESS DIGITAL AUDIO SYSTEM

Group Art Unit: 2644

Examiner: Andrew Graham

CERTIFICATE OF MAILING (37 C.F.R. § 1.8(a))

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail under 37 CFR 1.8(a) in an envelope addressed to, Mail Stop: Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on August 29, 2005.

Anita Chou

Mail Stop: Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL

Sir:

Transmitted herewith is a Petition for Unintentionally Delayed Claim for §120 Priority under 37 CFR §1.78(a)(3) and Exhibits for the above-identified application.

☒ Please charge my Deposit Account No. 50-1946 the amount of $1,370.00. A duplicate copy of this sheet is enclosed.

☒ We authorize the Commissioner to charge Deposit Account No. 50-1946 for payment of any additional fees required by this response or to credit any overpayment to the account.

August 29, 2005
DATE

Daphne L. Burton
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Attorney for Applicant

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Docket No. 073785-0013 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 33401
C. Earl WOOLFORK	:	Confirmation Number: 3337
Application No.: 10/648,012	:	Group Art Unit: 2644
Filed: August 26, 2003	:	Examiner: Graham, Andrew
For: WIRELESS DIGITAL AUDIO SYSTEM	:	

PETITION FOR UNINTENTIONALLY DELAYED CLAIM FOR § 120 PRIORITY UNDER 37 C.F.R. § 1.78(a)(3)

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicant respectfully requests acceptance of the revised priority claim in the above identified application.

U.S. Application No. 10/648,012 (hereinafter '012 application), filed on or about August 26, 2003, was filed as an utility application pursuant to 37 C.F.R. 1.53(b). As evident from the transmittal sheet (Exhibit A) submitted at the time the '012 application was filed, Applicant identified the '012 application as a continuation-in-part for U.S. Application No. 10/027,391 (hereinafter '391 application) filed on December 21, 2001.

However, in the continuation-in-part application dated August 25, 2003, which was the subject of the transmittal sheet, the priority claim provided the incorrect serial no. (Exhibit B) which inadvertently identified the '012 application as a continuation-in-part of serial no. 10/027, 739, rather than a continuation-in-part of the '391 application. Accordingly, the '391 application was not correctly identified in the specification as a prior U.S. application with benefit claimed

under 35 U.S.C. § 120. On or about October 25, 2004, Applicant's prior counsel submitted an amendment to the first line of the specification of the '391 application (Exhibit C, p. 3) so that the revised priority claim clarifies that priority is being claimed to the earlier filed '391 application.

Applicant petitions the Patent Office to accept the amendment to the first line of the specification of the '012 application, to contain reference to the benefit claimed under 35 U.S.C. § 120 to the '391 application.

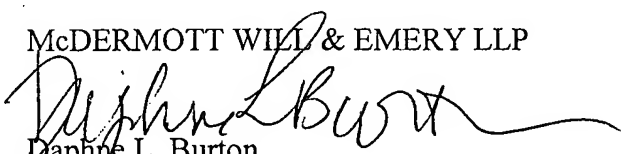
The entire delay in claiming priority to the '391 application between the date the claim was due under 37 C.F.R. § 1.78(a)(2)(ii) and the date the revised priority claim was filed was unintentional (see the attached declaration of applicant's prior counsel as Exhibit D).

The surcharge set forth by 37 C.F.R. §§ 1.78(a)(3)(ii), and 1.17(t) of $1,370.00 accompanies this petition. Please charge Deposit Account 501946 the fee of $1,370.00 if such petition is necessary to revise the priority claim.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 501946 and please credit any excess fees to such deposit account.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP



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Date: August 29, 2005

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10/648,012

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August 25, 2003

EV203842632US

Mail Stop Patent Application
Commissioner for Patents
P.O. Box 1450
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Serial No.:	10/027,391
Applicant:	C. Earl Woolfork
Filing Date:	12/21/2001
Group Art Unit:	2644
Examiner:	McChesney, Elizabeth A.
For:	WIRELESS DIGITAL AUDIO SYSTEM

Dear Assistant Commissioner for Patents:

This amendment, and fee for CIP application are filed to maintain the parent case which is to be abandoned when filing a new application claiming its benefit.

1. The amendment in this case is a bona fide attempt by applicant to respond and to advance this application to final action and comprises a separately filed:

(a) ___ Continuation Application

(b) _X_ Continuation-in-Part Application

(c) ___Divisional Application (where parent case is to be abandoned.

A copy of this amendment and petition is being filed with the papers constituting the filing of the separately filed application.

2. The amendment being filed in this case is attached.

3. This is not a petition for extension of time to respond to:

(d) ___ the Office Action mailed on _____, and Advisory Action dated _____.

(e) _X_ Other: The Office Action dated 02/26/2003 did not specify a shortened time period for reply.

4. Please abandon this application conditioned upon the granting of the petition and granting of a filing date to the continuing application so as to make the continuing application co-pending with this application.

5. Applicant is:

_X_ a small entity verified statement

_X_ is enclosed.

___ was filed in parent application (a copy attached) and this status is still proper and its benefit under 37 CFR 1.28 (a) is hereby claimed.

___ other than a small entity.

6. Extension requested under 37 CFR 1.17(c) is for _____ months to _____ for a fee of $---.--.

7. Enclosed is:

Continuation-in-Part Patent Application including:

11 pages of specifications
2 pages of drawings
Small Entity Statement
Combination Declaration and Power of Attorney
Nonpublication Request
Proof of Mailing
Self Addressed Postcard
A check in the amount of $375.00

This amount is based on:

5 claim and 3 independent claim	$375.00
0 independent claims in excess of three ($42.00)	0.00
0 claims in excess of twenty ($9.00)	0.00
TOTAL FILING FEE:	$375.00

Very truly yours,

DENNIS W. BEECH
Reg. No.: 35,443
DWB/ab
Enclosures

FUZZY AUDIO WIRELESS MUSIC SYSTEM

This is a continuation-in-part of application Serial No. 10/027,739 which patent application is pending.

BACKGROUND OF THE INVENTION

[0001] This invention relates to audio player devices and more particularly to systems that include headphone listening devices. The new audio system uses existing audio player device headphone jacks to connect a battery powered transmitter for wireless transmission of a signal to a battery powered receiving headphone.

[0002] Use of audio headphones with audio player devices such as radio, tape players, CD players, computers, television audio and the like have been in use for may years. These systems usually incorporate an audio source having a headphone jack to which a headphone may be connected by wire and connector.

[0003] There are also known wireless headphones that may receive A.M. and F.M. radio transmissions. However, these systems do not allow use of a simple plug in battery powered transmitter for connection to any audio player device jack, such as, laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players and the like, for wireless transmission and reception of audio music for private listening to multiple users occupying the same space. Existing audio systems make use of electrical wire connections between the audio source and the headphones to accomplish private listening to multiple users.

[0004] There is a need for a battery powered simple connection system for existing audio player devices, to allow wireless transmission to a headphone receiver that accomplishes private listening to multiple users occupying the same space.

SUMMARY OF THE INVENTION

[0005] The present invention is directed to FAWM (Fuzzy Audio Wireless Music) systems for coded digital transmission of an audio signal from any audio player device with a headphone jack to a receiver headphone using fuzzy logic technology. A battery powered digital transmitter may include a headphone plug in communication with any of the previously mentioned audio sources, laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players and the like. The FAWM system converts the audio music signal that may be supplied by the source, into a digital signal. This conversion takes place in the small battery powered transmitter that connects to the headphone jack of the source. The transmitter then adds a unique user code and transmits it to the battery powered receiver headphones where the fuzzy logic detector decodes only the unique user code to allow private listening without interference from other users.

[0006] These and other features, aspects and advantages of the present invention will become better understood with reference to the following drawings, description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Figure 1 illustrates a schematic diagram representation of the FAWM system;

Figure 2 illustrates a graph of the high and low bit fuzzy logic if-then part fuzzy set according to an embodiment of the invention.

DETAILED DESCRIPTION

[0008] The following detailed description is the best currently contemplated modes for carrying out the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention.

[0009] Referring to Figure 1, a FAWM system 10 may include a battery powered transmitter 20 connected to a portable audio player or audio source 80. The battery powered transmitter 20 may be connected to the audio source 80 headphone jack 82 using a headphone plug 22. The battery powered transmitter 20 may have a transmitting antenna 24 that may be omni-directional for transmitting a coded digital modulated signal to a receiving antenna 52 of a battery powered receiver 50 that may be a headphone receiver. The battery powered receiver 50 may have headphone speakers 54 in headphones 55 for listening to the demodulated and decoded digital signal. The FAWM transmitter 20 may digitize the audio signal. This digital signal has a throughput of approximately 1.4 Mbps, which may be determined by the analog to digital A/D converter sampling rate of 44.1kHz multiplied by 16 bit quantization. To reduce the effects of channel noise, the battery powered transmitter 20 may use convolutional encoding, and interleaving. For further noise immunity, spread spectrum modulation may be utilized. The battery powered transmitter 20 may contain a shift register generator (SRG) that may be used to create a unique user code. The unique user code generated is specifically associated with one FAWM user, and it is the only code recognized by the battery powered FAWM headphone receiver 50 of that particular user. The radio frequency (RF) spectrum utilized (as taken from the Industrial, Scientific and Medical (ISM) band), may be approximately 2.4 GHz. And the power radiated by the transmitter adheres to the ISM standard.

[0010] Referring to Figure 1, the digital modulated signal from transmit antenna 24 may be received by receiving antenna 52 and then demodulated,

decoded and deinterleaved in the battery powered receiver 50 headphones. The battery powered receiver 50 may utilize fuzzy logic to optimize the detection of the received user code.

[0011] Each receiver 50 user may be able to listen (privately) to high fidelity audio music, using any of the audio devices listed previously, without the use of wires, and without interference from any other receiver 50 user. Because of the fuzzy logic detection technique used in the wireless digital audio system, user separation through code division may be achieved.

[0012] The battery powered transmitter 20 sends the audio information to the battery powered receiver 50 in digital packet format. Each packet may consist of, at minimum, a start bit to indicate the beginning of a packet, the unique user code, the digitized audio information and a stop bit to indicate the end of a packet. These packets may flow to create a digital bit stream rate less than or equal to 1 Mb/s.

[0013] The user code bits in each packet may be received and detected by a fuzzy logic detector in the headset receiver 50. For each consecutive packet received, the fuzzy logic detector may compute a conditional density with respect to the context and fuzziness of the user code vector, i.e., the received user code bits in each packet. The fuzzy logic detector is the key component to the FAWM system 10. Because the fuzzy logic detector enables the battery powered FAWM receiver 50 to accurately detect the assigned user code in the presence of noise, which includes other FAWM users. Fuzziness may describe the ambiguity of the high (1)/low (0) bit event in the noisy received packet. Note that the fuzzy detector may measure the degree to which a high/low bit occurs in the user code vector, which produces a low probability of bit error in the presence of noise. The fuzzy detector may use a set of if-then rules to map the user code bit inputs to validation outputs. These rules may be developed as if-then statements.

[0014] The fuzzy logic detector in the battery powered receiver 50 utilizes the if-then fuzzy set to map the received user code bits into two values; a low

(0) and a high (1). Thus, as the user code bits are received, the "if" rules map the signal bit energy to the fuzzy set low value to some degree and to the fuzzy set high value to some degree. See Figure 2. Due to additive noise each user code bit (bit energy x) may have some membership to a low and high as represented in Figure 2. Therefore, the if-part fuzzy set may determine if each bit in the user code, for every received packet, has a greater membership to a high bit representation or a low bit representation. The more a user code bit energy, x fits into the high or low representation, the closer its subsethood, i.e., a measure of the degree to which a set may be a subset of another set, may be to one. Note that Figure 2 shows that -1 equals the maximum low bit energy representation and 1 equals the maximum high bit energy representation to illustrate that this design may utilize Manchester encoding/decoding schemes.

[0015] The received user code input bit in each packet may be:

x(i), where i = 1,2, ..., n is the set of all bits that make up the user code vector.

X(c), where c = 1, 2, ..., m represents each user assigned a unique user code.

So user X(1) has bit code [x(1) x (2) .....x(n)] and user X(m) has bit code [x(1) x (2) ....x(n)] which is different from user X(1).

[0016] Each x in X may activate a fuzzy "if" rule. The if-part sets may be conditional densities, so the fuzzy "if" rule activates to the degree p[x(i)|X(c)] p[X(c)], which is the probability of the user code bits x given the user vector X multiplied by the probability of X.

[0017] The then-part fuzzy rule set may be indirectly dependent on the input bits x in X. The then-part set may be a weighted sum equal to p[x(i)] p[y|x(i), i = 1, 2, ...,n.

[0018] Which is the probability of the user bit vector x multiplied by the probability of y given the user bit vector x. Where y may be a number representation to define the correct user headset battery powered receiver 50

given the input bit set x(i), I = 1, 2, ...,n.

[0019] The if-then rule parts that make up the fuzzy logic detector must be followed by a defuzzifying operation. This operation reduces the output fuzzy set to a single number that determines if the correct received user code bits within the transmitted packet have been detected. The defuzzifying operation may be implemented with the modal method, i.e., calculation of the value that has the highest membership in the fuzzy set. With the modal method a strategy of clarity may be applied in the event that some user code energy bit values have equally high membership. The clarity of a fuzzy set may be considered by weighting the conditional densities discussed previously. The weighting determines relative fuzziness of the user code energy bit (x) that gives a measure of the uncertainty of the unique user code vector. As a result, the fuzzy logic detector used in the battery powered headset receiver 50 greatly reduces the unique user code bit error probability. The fuzzy logic detector technique, combined with convolutional error detection and correction techniques, may enable the FAWM system 10 to operate in most any environment.

[0020] While the invention has been particularly shown and described with respect to the illustrated and preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

CLAIMS

I claim:

1. A fuzzy audio wireless music system for wireless transmission of a signal from an audio source to a battery powered headphone receiver comprising:

a headphone jack from an audio source in communication with a connectable battery powered transmitter;

said connectable battery powered transmitter contains an A/D converter wherein said A/D converter converts an analog music audio signal to a digital signal at a signal rate of approximately 1.4 Mbps;

said A/D converter in communication with a shift register generator, a convolutional encoder and an interleaver;

said interleaver in communication with a spread spectrum modulator;

said spread spectrum modulator in communication with a transmit antenna for wireless transmission of a coded digital signal to a receiving antenna at a radio frequency of approximately 2.4 GHz;

said receiving antenna in communication with a spread spectrum demodulator, a convolutional deinterleaver and a decoder; and

said decoder in communication with a fuzzy logic detector.

2. The fuzzy audio wireless music system as in claim 1 wherein said battery powered headphone receiver having said fuzzy logic detector with a detection method, comprising the steps of:

a) receiving a user code having:

x(i) where i = 1, 2, ..., n is the set of all bits that make up the user code vector;

X(c), where c = 1, 2, ..., m represents each user assigned

unique user code;

Wherein user X(1) has bit code [x(1) x (2).... X(n)] and user X(m) has bit code [x(1) x(2) ... x(n)] which is different form X(1);

b) activating a fuzzy if rule based on each x in X wherein the if part sets are conditional densities to activate the if rule to the degree p[x(i)|X(c)] p[X(c)];

c) activating a fuzzy then rule indirectly dependent on each x in X wherein the then part sets are a weighted sum equal to p[x(i)]p[y|x(i)], i = 1,2; ..., n; and

d) performing a defuzzifying operation of modal type.

3. A battery powered headphone receiver having a fuzzy logic detector method, comprising the steps of:

a) receiving a user code having:

x(i) where i = 1, 2, ..., n is the set of all bits that make up the user code vector;

X(c), where c = 1, 2, ..., m represents each user assigned unique user code;

wherein user X(1) has bit code [x(1) x (2).... X(n)] and user X(m) has bit code [x(1) x(2) ... x(n)] which is different form X(1);

b) activating a fuzzy if rule based on each x in X wherein the if part sets are conditional densities to activate the if rule to the degree p[x(i)|X(c)] p[X(c)];

c) activating a fuzzy then rule indirectly dependent on each x in X wherein the then part sets are a weighted sum equal to p[x(i)]p[y|x(i)], i = 1,2, ..., n; and

d) performing a defuzzifying operation of modal type.

4. A method for battery powered digital wireless transmission and reception of high fidelity audio music between a battery operated transmitter

and a battery operated receiver comprising the step of:

connecting a headphone plug attached to said battery operated transmitter to a headphone jack of an audio source;

converting an music audio signal to a digital signal using an A/D converter having a sampling rate of approximately 44.1 kHz multiplied by 16 bit quantization to produce a signal rate of approximately 1.4 Mbps;

encoding the digital signal using a convolutional encoding and interleaving method;

creating a spread spectrum signal using a shift register generator to modulate a unique user code;

transmitting said spread spectrum signal at a radio frequency of approximately 2.4 GHz at a power level that adheres to the ISM standard for reception at a distance of up to approximately 10 feet from said battery operated transmitter;

receiving said spread spectrum signal at said battery operated receiver headphones;

demodulating said spread spectrum signal and optimal bit detecting of said unique user code using fuzzy logic technology;

convolutional decoding and deinterleaving to receive said digital signal;

converting said digital signal to said analog music audio signal; and

communication said analog music audio signal to a headphone speaker.

5. The battery powered receiver headphone as in claim 4 wherein said receiver having a fuzzy logic detector method comprising the steps of:

a) receiving a user code having:

x(i) where I = 1, 2, ..., n is the set of all bits that make up the user code vector;

X(c), where c = 1, 2, ..., m represents each user assigned unique user code;

Wherein user X(1) has bit code [x(1) x (2).... X(n)] and user X(m) has bit code [x(1) x(2) ... x(n)] which is different form X(i);

b) activating a fuzzy if rule based on each x in X wherein the if part sets are conditional densities to activate the if rule to the degree p[x(i)|X(c)] p[X(c)];

c) activating a fuzzy then rule indirectly dependent on each x in X wherein the then part sets are a weighted sum equal to p[x(i)]p[y|x(i)], i = 1,2, ..., n; and

d) performing a defuzzifying operation of modal type.

FUZZY AUDIO WIRELESS MUSIC SYSTEM

ABSTRACT OF THE DISCLOSURE

[0021] The fuzzy audio wireless music system may utilize a battery powered transmitter to transmit a coded digital signal from an audio player device or source to a battery powered headphone receiver without the use of wires. A battery powered digital transmitter may include a headphone plug in communication with any audio source, such as, laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players, etc. The battery powered transmitter adds a unique user code and transmits it to the battery powered receiver headphones where a fuzzy logic detector decodes only the unique user code to allow private listening without interference from other users.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In regards to application of:

Serial Number:	10/027,391
Applicant:	C. EARL WOOLFORK
Filing Date:	12-21-01
Group Art Unit:	2644
Examiner:	MC CHESNEY, ELIZABETH A.
For:	WIRELESS DIGITAL AUDIO SYSTEM

Box: Non-Fee Amendment
Assistant Commissioner for Patents
Washington, DC 20231

CERTIFICATE OF MAILING UNDER 37 CFR § 1.10

Express Mail label number: EL 870683609 US
Date of Deposit: November 26, 2002

I hereby certify that the following attached correspondence comprising:

8 page specifications
1 page drawing
Version with Markings to Show Changes Made

is being deposited with the United States Postal Service as Express Mail to Addressee" service under 37 CFR § 1.10 on the date indicated below and is addressed to:

BOX: Non-Fee Amendment
Assistant Commissioner for Patents
Washington, DC 20231

Date: 11-26-02

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EXPRESS MAIL
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October 25, 2004

Mail Stop NON-FEE AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Serial Number:	10/648,012
Applicant:	C. Earl Woolfork
Filing Date:	08/26/2003
Title:	WIRELESS DIGITAL AUDIO SYSTEM
TC/AU:	2644
Examiner:	Graham, Andrew R.

PRELIMINARY AMENDMENT

TO THE COMMISSIONER FOR PATENTS:

The following preliminary amendment is submitted for US Patent Application No. 10/648,012 filed on 08-26-2003.

Applicant respectfully submits the following amendments to the application. Applicant believes this amendment is supported by the original disclosure and that no new matter is added by this amendment.

AMENDMENTS

Amendments to the Specification begin on page 3 of this paper.

Amendments to the Claims are reflected in the listing of claims that begins on page 9 of this paper.

Remarks/Arguments begin on page 13 of this paper.

AMENDMENTS TO THE SPECIFICATION

In the Abstract of the Disclosure: (Place a replacement or new abstract on a separate sheet)

[0021] The fuzzy audio wireless music system utilizes a battery powered BLUETOOTH compliant transmitter to transmit a coded ~~digital~~ BLUETOOTH communication signal from an existing non-BLUETOOTH analog headphone jack of a music audio player device or source to a battery powered BLUETOOTH compliant headphone receiver without the use of wires. A battery powered ~~digital~~ BLUETOOTH compliant transmitter may include a headphone plug in communication with a standard analog headphone jack on a audio source, such as, laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players,...,etc. The battery powered BLUETOOTH compliant transmitter adds a unique user code as defined in the BLUETOOTH standard and transmits it to the battery powered BLUETOOTH compliant receiver headphones where a fuzzy logic ~~detector~~ detection system may be used to enhance decoding performance. ~~decodes only the unique user code to~~ The BLUETOOTH communication FAWM system will allow private listening without interference from other users, and without the inconvenience of wires.

In the Specifications:

Please replace the paragraphs and the beginning of the specification with the following rewritten paragraphs and beginning:

FUZZY AUDIO WIRELESS MUSIC SYSTEM

This is a continuation-in-part of application Serial No. ~~10/027,739~~ 10/027,391 which patent application is pending.

BACKGROUND OF THE INVENTION

[0001] This invention relates to music audio player devices and more particularly to systems that include headphone listening devices. The new audio music system uses an existing ~~device~~ non-BLUETOOTH headphone jack (i.e., this is the standard analog headphone jack that connects to wired headphones) of a music audio player (i.e., portable CD player, portable cassette player,

portable A.M./F.M. radio, laptop/desktop computer, portable MP3 player, and the like) to connect a battery powered BLUETOOTH compliant transmitter for digital wireless transmission of a BLUETOOTH communication signal to a set of battery powered BLUETOOTH compliant receiver headphones. BLUETOOTH is a worldwide wireless standard. Detailed Information regarding the standard is available on the web site www.bluetooth.com.

[0002] Use of music audio headphones with music audio player devices such as ~~radio, tape players, CD players, computers, television audio~~ portable CD players, portable cassette players, portable A.M./F.M. radios, laptop/desktop computer, portable MP3 players and the like, have been in use for may years. These systems incorporate an audio source having a analog non-BLUETOOTH headphone jack to which headphones may be connected by wire ~~and connector~~ .

[0003] There are also known non-portable wireless headphones that may receive ~~A.M. and F.M. radio~~ infrared (IR) transmissions. However, these systems operate with a narrow beam width that requires a point-and-shoot style for reception. ~~these systems~~ They do not allow use of a simple plug in (i.e., plug in to the existing analog audio headphone jack) battery powered BLUETOOTH compliant transmitter for connection to any music audio player device jack, ~~such as, laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players and the like~~, such as the above mentioned music audio player devices for coded digital wireless transmission and reception by BLUETOOTH compliant headphones of audio music for private listening to multiple users occupying the same space without the use of wires. Existing audio systems make use of electrical wire connections between the audio source and the headphones to accomplish private listening to multiple users.

[0004] There is a need for a battery powered simple connection system for existing music audio player devices (i.e., the previously mentioned music devices), to allow coded digital wireless transmission (using a battery powered BLUETOOTH compliant transmitter) to a headphone receiver (using battery powered BLUETOOTH compliant receiver headphones) that accomplishes private listening to multiple users occupying the same space without the use of wires.

SUMMARY OF THE INVENTION

[0005] The present invention is directed to FAWM (Fuzzy Audio Wireless Music) systems for coded digital transmission, per the BLUETOOTH standard, of an analog audio signal from any music audio player device with a non-BLUETOOTH analog headphone jack to a receiver headphone, which adheres to the BLUETOOTH standard. ~~using~~ Fuzzy logic technology may be

utilized by the FAWM system to enhance bit detection. A battery powered ~~digital~~ BLUETOOTH compliant transmitter may include a headphone plug in communication with any of the previously mentioned music audio sources ~~laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players and the like~~. For reception, a battery powered BLUETOOTH compliant headphone receiver may apply fuzzy logic to enhance bit detection. Fuzzy logic detection may be used to enhance bit detection during decoding of the BLUETOOTH communication signal. The FAWM system ~~converts the audio music signal that may be supplied by the source, into a digital signal. This conversion takes place in the small battery powered transmitter that connects to the headphone jack of the source. The transmitter then adds a unique user code and transmits it to the battery powered receiver headphones where the fuzzy logic detector decodes only the unique user code to allow~~ will provide private listening without interference from other users and without the use of wires.

[0006] These and other features, aspects and advantages of the present invention will become better understood with reference to the following drawings, description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Figure 1 illustrates a schematic diagram representation of the FAWM system;

Figure 2 illustrates a graph of the high and low bit fuzzy logic if-then part fuzzy set according to an embodiment of the invention.

DETAILED DESCRIPTION

[0008] The following detailed description is the best currently contemplated modes for carrying out the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention.

[0009] Referring to Figure 1, a FAWM system 10 may include a battery powered BLUETOOTH compliant transmitter 20 connected to a portable music audio player (or music audio source) 80. The battery powered BLUETOOTH compliant transmitter 20 that utilizes a CODEC and BLUETOOTH front end may be connected to the music audio source 80 analog non-BLUETOOTH headphone jack 82 using a headphone plug 22. The battery powered BLUETOOTH compliant transmitter 20 may have a transmitting antenna 24 that may be omni-directional for transmitting a

~~coded digital~~ spread spectrum modulated signal, which adheres to the BLUETOOTH standard, to a receiving antenna 52 of a battery powered BLUETOOTH compliant headphone receiver 50. The battery powered BLUETOOTH compliant receiver 50 may have headphone speakers 54 in headphones 55 for listening to the spread spectrum demodulated and decoded ~~digital~~ BLUETOOTH communication signal. During decoding, fuzzy logic detection may be used to increase receiver decoding performance. The FAWM BLUETOOTH compliant transmitter 20 may digitize the audio signal per the BLUETOOTH standard using a CODEC and BLUETOOTH front end. This BLUETOOTH compliant digital signal has a throughput of approximately 1.4 Mbps that may be as low as approximately 1.0 Mbps. ~~which may be determined by the analog to digital A/D converter sampling rate of 44.1kHz multiplied by 16 bit quantization.~~ To reduce the effects of channel noise, the battery powered BLUETOOTH compliant transmitter 20 may use convolutional channel encoding ~~and interleaving~~. For further noise immunity, spread spectrum modulation, as defined in the BLUETOOTH standard ~~may be~~ is utilized. The battery powered BLUETOOTH compliant transmitter 20 may contain a BLUETOOTH compliant shift register generator, or the like, that may be used to create a unique user code. The unique user code generated is specifically associated with one FAWM user, and it is the only code recognized by the battery powered FAWM BLUETOOTH compliant headphone receiver 50 ~~of that~~ operated by a particular user. The radio frequency (RF) spectrum utilized (as taken from the Industrial, Scientific and Medical (ISM) band), may be approximately 2.4 GHz as defined in the BLUETOOTH standard. And the power radiated by the BLUETOOTH compliant transmitter adheres to the BLUETOOTH standard.

[0010] Referring to Figure 1, the ~~digital~~ spread spectrum modulated BLUETOOTH compliant signal from transmit antenna 24 may be received by receiving antenna 52 and then spread spectrum demodulated per the BLUETOOTH standard, ~~decoded and deinterleaved~~ in the battery powered BLUETOOTH compliant receiver 50 headphones. The battery powered BLUETOOTH compliant receiver 50 may utilize fuzzy logic to optimize the bit detection of the received packet code.

[0011] Each BLUETOOTH compliant receiver headphone 50 user may be able to listen (privately) to high fidelity audio music, using any of the audio devices listed previously, without the use of wires, and without interference from any other BLUETOOTH compliant receiver headphone 50 user. . ~~Because of the fuzzy logic detection technique used in the wireless digital audio system, user separation through code division may be achieved.~~ The fuzzy logic detection technique that may be used in the FAWM could provide greater user separation through optimizing code division in the BLUETOOTH compliant headphone receiver.

[0012] The battery powered BLUETOOTH compliant transmitter 20 sends the audio music

information to the battery powered BLUETOOTH compliant receiver 50 in digital packet format as defined in the BLUETOOTH standard. These packets may flow to create a digital bit stream rate of less than or equal to 1.0 Mbps as defined in the BLUETOOTH standard.

[0013] The ~~user~~ code bits in each packet may also be received and detected by a fuzzy logic detection system (as an option) in the headset receiver 50 to provide additional decoding performance. For each consecutive packet received, the fuzzy logic detection system may compute a conditional density with respect to the context and fuzziness of the ~~user~~ packet code vector, i.e., the received ~~user~~ code bits in each packet. The fuzzy logic ~~detector~~ detection system ~~is the key component to the~~ may enable the battery powered FAWM BLUETOOTH compliant ~~system 10. Because the fuzzy logic detector enables the battery powered FAWM~~ receiver 50 to enhance the bit detection accuracy of the packet code in the presence of noise, which may include other FAWM users. Fuzziness may describe the ambiguity of the high bit (1)/low bit (0 or -1) bit event in the received code within the packet. ~~Note that the~~ The fuzzy logic detection system ~~detector~~ may measure the degree to which a high/low bit occurs in the ~~user~~ packet code vector, which produces a low probability of bit error in the presence of noise. The fuzzy logic detection system may use a set of if-then rules to map the code bit inputs to validation outputs. These rules may be developed as if-then statements.

[0014] The fuzzy logic ~~detector~~ detection system in the battery powered BLUETOOTH compliant headphone receiver 50 utilizes the if-then fuzzy set to map the received ~~user~~ code bits into two values; a low (0 or -1) and a high (1). Thus, as the ~~user~~ code bits are received, the "if" rules map the signal bit energy to the fuzzy set low value to some degree and to the fuzzy set high value to some degree. See Figure 2. ~~Due to additive noise each user code bit (bit energy x) may have some membership to a low and high as represented in Figure 2. Therefore, the if-part fuzzy set may determine if each bit in the user code, for every received packet, has a greater membership to a high bit representation or a low bit representation. The more a user code bit energy, x fits into the high or low representation, the closer its subsethood, i.e., a measure of the degree to which a set may be a subset of another set, may be to one. Note that~~ ~~Note that~~ Figure 2 shows that -1 equals the maximum low bit energy representation and 1 equals the maximum high bit energy representation ~~to illustrate that this design may utilize Manchester encoding/decoding schemes.~~ Due to additive noise, the code bit energy may have some membership to low and high as represented in Figure 2. The if-part fuzzy set may determine if each bit in the code, for every received packet, has a greater membership to a high bit representation or a low bit representation. The more a user code bit energy fits into the high or low representation, the closer its subsethood,

i.e., a measure of the degree to which a set may be a subset of another set, may be to one.

[0015] ~~The received user code input bit in each packet may be:~~

~~x(i), where i = 1,2, ..., n is the set of all bits that make up the user code vector.~~

~~X(c), where c = 1, 2, ..., m represents each user assigned a unique user code.~~

~~So user X(1) has bit code [x(1) x (2) .....x(n)] and user X(m) has bit code [x(1) x (2) ....x(n)] which is different from user X(1).~~

[0016] ~~Each x in X may activate a fuzzy "if" rule. The if-part sets may be conditional densities, so the fuzzy "if" rule activates to the degree p[x(i)|X(c)] p[X(c)], which is the probability of the user code bits x given the user vector X multiplied by the probability of X.~~

[0017] ~~The then-part fuzzy rule set may be indirectly dependent on the input bits x in X. The then-part set may be a weighted sum equal to p[x(i)] p[y|x(i), i = 1, 2, ...,n.~~

[0018] ~~Which is the probability of the user bit vector x multiplied by the probability of y given the user bit vector x. Where y may be a number representation to define the correct user headset battery powered receiver 50 given the input bit set x(i), I = 1, 2, ...,n.~~

[0019] The if-then rule parts that make up the fuzzy logic ~~detector~~ detection system must be followed by a defuzzifying operation. This operation reduces the ~~output~~ aforementioned fuzzy set to a bit energy representation (i.e., -1 or 1) ~~single number that determines if the correct~~ that is received ~~user code bits within~~ by the transmitted BLUETOOTH standard packet. ~~have been detected. The defuzzifying operation may be implemented with the modal method, i.e., calculation of the value that has the highest membership in the fuzzy set. With the modal method a strategy of clarity may be applied in the event that some user code energy bit values have equally high membership. The clarity of a fuzzy set may be considered by weighting the conditional densities discussed previously. The weighting determines relative fuzziness of the user code energy bit (x) that gives a measure of the uncertainty of the unique user code vector. As a result, the fuzzy logic detector used in the battery powered headset receiver 50 greatly reduces the unique user code bit error probability.~~ The fuzzy logic detection system may be used in the battery powered BLUETOOTH compliant headset receiver 50 to enhance overall FAWM system 10 decoding performance. ~~The fuzzy logic detector technique, combined with convolutional error detection and correction techniques, may enable the FAWM system 10 to operate in most any environment.~~

[0020] While the invention has been particularly shown and described with respect to the illustrated and preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (currently amended): A fuzzy audio wireless music system for ~~wireless transmission of a signal from~~ BLUETOOTH communication of an audio music signal from the non-BLUETOOTH analog headphone jack connected to a battery powered BLUETOOTH compliant transmitter and received by a battery powered BLUETOOTH compliant ~~source to a battery powered~~ headphone receiver comprising:

a NON-BLUETOOTH compliant analog headphone jack from an audio music source in communication with ~~a connectable~~ said battery powered BLUETOOTH compliant transmitter;

said ~~connectable~~ battery powered BLUETOOTH compliant transmitter converts an analog audio music signal from said existing non-BLUETOOTH analog headphone jack to a BLUETOOTH compliant ~~contains an A/D converter wherein said A/D converter converts an analog music audio signal to a~~ digital signal using a CODEC and a BLUETOOTH front end at a signal rate of approximately 1.4 Mbps as defined in the BLUETOOTH standard;

said ~~A/D converter~~ CODEC in communication with a shift register generator that is BLUETOOTH compliant to create a unique user code and a convolutional encoder ~~and an interleaver~~ ;

said ~~interleaver~~ shift register generator in communication with a spread spectrum modulator that is BLUETOOTH compliant;

said BLUETOOTH compliant spread spectrum modulator in communication with a transmit antenna for ~~wireless~~ BLUETOOTH compliant transmission of a coded ~~digital signal~~ BLUETOOTH compliant packet to a receiving antenna at a radio frequency of approximately 2.4 GHz as defined in the BLUETOOTH standard;

said receiving antenna in communication with a spread spectrum demodulator that is BLUETOOTH compliant and a convolutional ~~deinterleaver and a~~ decoder; and

said ~~decoder~~ BLUETOOTH compliant spread spectrum demodulator in communication with a fuzzy logic ~~detector~~ detection system for additional decoding performance.

2. (currently amended): The fuzzy audio wireless music system as in claim 1 wherein said battery powered BLUETOOTH compliant headphone receiver having said fuzzy logic ~~detector~~ detection system with a detection method, comprising the steps of:

a) receiving a ~~user~~ BLUETOOTH compliant packet code bits having:

~~x(i) where i = 1, 2, ..., n is the set of~~ all bits that make up the packet ~~user~~ code ~~vector~~;

~~X(c), where c = 1, 2, ..., m represents each user assigned unique user code; wherein user X(1) has bit code [x(1) x (2).... X(n)] and user X(m) has bit code [x(1) x(2) ... x(n)] which is different form X(1)~~;

b) activating a fuzzy logic if rule for each bit energy in the packet code ~~based on each x in X wherein the if part sets are conditional densities to activate the if rule to the degree p[x(i)|X(c)] p[X(c)]~~;

c) activating a fuzzy then rule indirectly dependent on each ~~x in X wherein the then part sets are a weighted sum equal to p[x(i)]p[y|x(i)], i = 1,2, ..., n~~ received bit energy; and

d) performing a defuzzifying fuzzy logic operation to relate the bit energy to one of a digital one(1) and digital zero(0) bit representation. ~~of modal type.~~

3. (currently amended): A battery powered BLUETOOTH compliant headphone receiver possibly having ~~a~~ an additive fuzzy logic ~~detector~~ detection method, comprising the steps of:

a) receiving ~~a user~~ BLUETOOTH compliant packet code bits having:

~~x(i) where i = 1, 2, ..., n is the set of~~ all bits that make up the packet ~~user~~ code ~~vector~~;

~~X(c), where c = 1, 2, ..., m represents each user assigned unique user code; wherein user X(1) has bit code [x(1) x (2).... X(n)] and user X(m) has bit code [x(1) x(2) ... x(n)] which is different form X(1)~~;

b) activating a fuzzy logic if rule for each bit energy in the packet code ~~x in X wherein the if part sets are conditional densities to activate the if rule to the degree p[x(i)|X(c)] p[X(c)]~~;

c) activating a fuzzy then rule indirectly dependent on each ~~x in X wherein the~~

~~then part sets are a weighted sum equal to p[x(i)]p[y|x(i)], i = 1,2, ..., n~~ received bit energy; and

d) performing a defuzzifying fuzzy logic operation to relate the bit energy to one of a digital one(1) and digital zero(0) bit representation. ~~operation of modal type.~~

4. (currently amended): A method for battery powered ~~digital~~ wireless BLUETOOTH communication transmission and reception of high fidelity audio music between a battery operated BLUETOOTH compliant transmitter and a battery operated BLUETOOTH compliant receiver headphone comprising the step of:

connecting the plug attached to said battery operated BLUETOOTH compliant transmitter to ~~a~~ the existing non-BLUETOOTH compliant analog headphone jack of an audio music source;

converting ~~an~~ a music audio signal to a ~~digital~~ BLUETOOTH communication signal using ~~an A/D converter having a sampling rate of approximately 44.1 kHz multiplied by 16 bit quantization to produce a signal rate of approximately 1.4 Mbps~~ a CODEC and a BLUETOOTH front end;

encoding the ~~digital~~ BLUETOOTH communication signal using ~~a convolutional~~ BLUETOOTH standard convolutional encoding ~~and interleaving method~~;

creating a BLUETOOTH standard spread spectrum signal using a shift register generator to modulate a unique user code that adheres to the BLUETOOTH standard;

transmitting said BLUETOOTH standard spread spectrum signal at a radio frequency of approximately 2.4 GHz at a power level that adheres to the ~~ISM~~ BLUETOOTH standard for reception at a distance ~~of up to 10~~ less than approximately 30 feet from said battery operated BLUETOOTH compliant transmitter;

receiving said BLUETOOTH compliant spread spectrum signal at said battery operated BLUETOOTH compliant receiver headphones;

demodulating said BLUETOOTH compliant spread spectrum signal; ~~and optimal bit detecting of said unique user code using fuzzy logic technology;~~

convolutional ~~decoding and deinterleaving to receive said digital signal;~~ decoding of said BLUETOOTH communication signal as defined in the BLUETOOTH standard, with an option to apply fuzzy logic detection system to enhance bit detection performance;

converting said ~~digital~~ BLUETOOTH communication signal back to said analog music audio signal; and

communication said analog music audio signal to a headphone speaker within the

BLUETOOTH compliant headphone receiver.

5. (currently amended): The ~~battery powered receiver headphone~~ method as in claim 4 wherein said battery operated BLUETOOTH compliant receiver having a fuzzy logic detector method comprising the steps of:

a) receiving ~~a user~~ BLUETOOTH compliant packet code bits having:

~~x(i) where i = 1, 2, ..., n is the set of~~ all bits that make up the packet ~~user~~ code ~~vector~~;

~~X(c), where c = 1, 2, ..., m represents each user assigned unique user code; wherein user X(1) has bit code [x(1) x (2).... X(n)] and user X(m) has bit code [x(1) x(2) ... x(n)] which is different form X(1)~~;

b) activating a fuzzy logic if rule for each bit energy in the packet code ~~based on each x in X wherein the if part sets are conditional densities to activate the if rule to the degree p[x(i)|X(c)] p[X(c)]~~;

c) activating a fuzzy then rule indirectly dependent on each ~~x in X wherein the then part sets are a weighted sum equal to p[x(i)]p[y|x(i)], i = 1,2, ..., n~~ received bit energy; and

d) performing a defuzzifying fuzzy logic operation to relate the bit energy to one of a digital one(1) and digital zero(0) bit representation. ~~operation of modal type.~~

REMARKS/ARGUMENTS

The applicant has provided the following analysis concerning non-introduction of new matter for this preliminary amendment.

"A Special Interest Group (SIG) was formed to create an industry standard for short range low power radio frequency (RF) connectivity to make free use of intellectural property in a specification. The specification is called Bluetooth. The SIG determined a short range low power RF protocol for personal wireless connectivity technologies that allow personal devices to communicate. The Bluetooth wireless technology serves as a replacement of the interconnecting cables between personal electronic devices. Because the FAWM design replaces the interconnecting cable between a portable audio music device and a pair of headphones, it was necessary to follow the Bluetooth specification to adhere to the RF, low power wireless protocol.

In the initial patent application and the CIP the Bluetooth protocol was described, but the name (Bluetooth) was not called out. The key Bluetooth specifications are as follows: The (1) carrier frequency of approximately 2.4 GHz is in the ISM (Industrial, Scientific, & Medical) band, and the (2) data rate is approximately 1 Mbps. The (3) transmit power is not greater than 100 mW (milliwatts), and has a (4) operating range up to 30 ft (or 10 m). To correct errors that may occur during packet transmission, (5) convolutional encoding is used. Finally, (6) spread spectrum technology is used for maximum immunity to interference.

Each of the Bluetooth specifications listed has been included in the initial patent application and the CIP".

No additional fee for claims is seen to be required.

If you have any questions do not hesitate to contact me.

Very truly yours,

DENNIS W. BEECH
Reg. No.: 35,443

DWB/ab

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In regards to application of:

Serial Number:	10/648,012
Applicant:	C. Earl Woolfork
Filing Date:	08/26/2003
Title:	WIRELESS DIGITAL AUDIO SYSTEM
TC/AU:	2644
Examiner:	Graham, Andrew R.

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

EXPRESS MAIL CERTIFICATE MAILING UNDER 37 CFR § 1.10

"Express Mail" label number: EV 482347413 US

Date of Deposit: October 25, 2004

I hereby certify that the following attached correspondence comprising:

13 Pages of response

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR § 1.10 on the date indicated above and is addressed to:

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Date: 10-25-04

ANNEROSE BEECH

Customer No. 33401

Attorney Docket No. 073785-0013

DECLARATION FOR PATENT APPLICATION

My name is Dennis W. Beech. I am a registered patent attorney who represented C. Earl Woolfork in the filing of a continuation-in-part application serial no. 10/648,012 ("the '012 application"). The '012 application was submitted to the United States Patent and Trademark Office on or about August 25, 2003. I represented C. Earl Woolfork in relation to the '012 application from the date of submission of the '012 application until on or about July 25, 2005.

On the date of submission of the '012 application, a typographical error was made with respect to the application serial number in the first line of the specification. The first line of the specification provided that the '012 application claimed the benefit of priority of U.S. patent application serial no. 10/027,739. The '012 application was intended to include a priority claim to U.S. patent application serial no. 10/027,391. A preliminary amendment was submitted to this effect on or about October 25, 2004.

The entire delay between the date the claim was due and the date the claim was filed was unintentional.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of Declarant	Declarant's signature	Date
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